

WHAT IS CLAIMED IS:

1. A cleaning nozzle comprising:

an ejection nozzle portion having a minimum diameter portion and a trumpet-shaped portion formed by multiple inclined 5 portions located upstream of said minimum diameter portion;

a gas ejection port formed along said multiple inclined portions and opened to an intermediate part of said trumpet-shaped portion;

another inclined portion having its inclination angle 10 with respect to an axis of said ejection nozzle portion smaller than an ejection angle of said gas ejection port and interposed between said gas ejection port and said minimum diameter portion; and

15 a cleaning liquid ejection port formed inside said gas ejection port;

whereby a gas is ejected from said gas ejection port at a speed higher than that of a cleaning liquid from said cleaning liquid ejection port to transform the cleaning liquid into droplets and to accelerate them.

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2. A cleaning nozzle according to claim 1, wherein a gas jet flow passing through a central part of said gas ejection port converges at a point upstream of said minimum diameter portion.

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3. A cleaning nozzle according to claim 1, wherein a cross-sectional area of said gas ejection port perpendicular to a direction of its axis is progressively reduced toward its downstream open end to accelerate the gas.

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4. A cleaning nozzle according to claim 1, wherein a cross-sectional area of said gas ejection port at its downstream open end is set almost equal to or slightly smaller than that of said minimum diameter portion.

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5. A cleaning nozzle according to claim 1, wherein a ratio between a cross-sectional area of said gas ejection port at its downstream open end and a cross-sectional area of the minimum diameter portion is set to 1:1 to 1:1.3.

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6. A cleaning nozzle according to claim 1, wherein a distance from said cleaning liquid ejection port to a downstream end of said ejection nozzle portion is 10-50 times a diameter of said minimum diameter portion.

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7. A cleaning nozzle according to claim 1, wherein a powder material can be supplied to an upstream side of said gas ejection port.

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8. A cleaning nozzle comprising:

an ejection nozzle portion having a minimum diameter portion and a trumpet-shaped portion formed by a curved surface located upstream of said minimum diameter portion, an  
5 inclination angle of a tangent to the curved surface progressively decreasing toward said minimum diameter portion;

a gas ejection port formed along the curved surface and opened to an intermediate part of said trumpet-shaped portion;  
and

10 a cleaning liquid ejection port formed inside said gas ejection port;

whereby a gas is ejected from said gas ejection port at a speed higher than that of a cleaning liquid from said cleaning liquid ejection port to transform the cleaning liquid into  
15 droplets and to accelerate them.

9. A cleaning nozzle according to claim 8, wherein a gas jet flow passing through a central part of said gas ejection port converges at a point upstream of said minimum diameter  
20 portion.

10. A cleaning nozzle according to claim 8, wherein a cross-sectional area of said gas ejection port perpendicular to a direction of its axis is progressively reduced toward its  
25 downstream open end to accelerate the gas.

11. A cleaning nozzle according to claim 8, wherein a cross-sectional area of said gas ejection port at its downstream open end is set almost equal to or slightly smaller than that of said minimum diameter portion.

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12. A cleaning nozzle according to claim 8, wherein a ratio between a cross-sectional area of said gas ejection port at its downstream open end and a cross-sectional area of the minimum diameter portion is set to 1:1 to 1:1.3.

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13. A cleaning nozzle according to claim 8, wherein a distance from said cleaning liquid ejection port to a downstream end of said ejection nozzle portion is 10-50 times a diameter of said minimum diameter portion.

14. A cleaning nozzle according to claim 8, wherein a powder material can be supplied to an upstream side of said gas ejection port.

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15. A cleaning nozzle comprising:

a converging-diverging nozzle portion having a minimum diameter portion and a trumpet-shaped portion formed upstream of said minimum diameter portion;

25 a gas ejection port formed along said trumpet-shaped portion and opened into an intermediate part of said

trumpet-shaped portion; and

a cleaning liquid ejection port formed inside said gas ejection port;

whereby a gas is ejected at a higher speed than that of  
5 a cleaning liquid to transform the cleaning liquid into droplets and the droplets are further accelerated downstream of these ejection ports before being ejected out from the cleaning nozzle.

16. A cleaning nozzle according to claim 15, wherein  
10 a gas jet flow passing through a central part of said gas ejection port converges at a point upstream of said minimum diameter portion.

17. A cleaning nozzle according to claim 15, wherein  
15 a cross-sectional area of said gas ejection port perpendicular to a direction of its axis is progressively reduced toward its downstream open end to accelerate the gas.

18. A cleaning nozzle according to claim 15, wherein  
20 a cross-sectional area of said gas ejection port at its downstream open end is set almost equal to or slightly smaller than that of said minimum diameter portion.

19. A cleaning nozzle according to claim 15, wherein  
25 a ratio between a cross-sectional area of said gas ejection

port at its downstream open end and a cross-sectional area of the minimum diameter portion is set to 1:1 to 1:1.3.

20. A cleaning nozzle according to claim 15, wherein  
5 a distance from said cleaning liquid ejection port to a downstream end of said ejection nozzle portion is 10-50 times a diameter of said minimum diameter portion.

21. A cleaning nozzle according to claim 15, wherein  
10 a powder material can be supplied to an upstream side of said gas ejection port.

22. A cleaning apparatus comprising:  
a cleaning nozzle; and  
15 a pressurized gas flow passage for carrying a pressurized gas flow;

wherein the pressurized gas flow injected with powder is supplied to the cleaning nozzle where it is mixed with a liquid to form a gas-liquid mixture flow containing the powder,  
20 and the gas-liquid mixture flow is applied to an object for cleaning by a delaminating action;

wherein a small amount of clogging prevention liquid is injected into an intermediate section of the pressurized gas flow passage between a powder injection portion and the cleaning  
25 nozzle.

23. A cleaning apparatus according to claim 22, wherein the amount of the clogging prevention liquid is smaller than that of liquid supplied to the cleaning nozzle.

5 24. A cleaning apparatus according to claim 22, wherein the amount of the clogging prevention liquid is smaller by weight than that of the powder injected.

10 25. A cleaning apparatus according to claim 22, wherein the amount of the clogging prevention liquid is smaller by volume than 1/1000 that of the pressurized gas flow.

15 26. A cleaning apparatus according to claim 22, wherein the clogging prevention liquid is made to continue to be injected for a predetermined period after the injection of powder into the pressurized gas flow has stopped.